CLAIMS

1. A heat exchanger for heat exchanging between an exhaust gas of an internal combustion engine and a cooling fluid, comprising:

a plurality of flat exhaust gas passages through which said exhaust gas flows therein; and

a plurarity of corrugated fins arranged in each of said exhaust gas passage, each of said fin including a plurarity of flat plate portions, a plurarity of side wall portions, and a louvre disposed on the inner wall of said exhaust gas passage, wherein the louvre difining a surface thereof arranged along the exhaust gas flow direction, has a height from said inner wall increase towards upstream of said exhaust gas flow, and said louvre is inclined with predetermined angle to a direction of said exhaust gas flow.

2. A heat exchanger according to claim 1,

wherein a plurality of said louvres are configured of a plurarity of pairs of said louvres,

and a gap between each said louvres gradually increases towards downstream of said exhaust gas.

3. A heat exchanger according to claim 2,

wherein said corrugated fins each include a plurality of flat plate portions substantially parallel to the long diameter of said exhaust gas passage and a plurality of side wall portions formed at an angle to said flat plate portions as viewed from the direction of the exhaust gas flow, and

wherein said louvres are each formed by cutting parts of each of said flat plate portions.

4. A heat exchanger according to claim 3,

wherein holes formed by cutting up parts of each of said flat plate portions are closed by defining members defining said exhaust gas passages.

5. A heat exchanger according to claim 2,

wherein the upstream end portions of each

of said sets of said louvres in said exhaust gas flow are arranged in a spaced relation with each other.

6. A heat exchanger according to claim 2, wherein the distance (δ) between the downstream end of each of said louvres in said exhaust gas flow and said side wall portion is not less than 0.5 times as large as the maximum height (h) of said louvre but more than twice as large as the maximum height (h) of said louvre.

7. A heat exchanger according to claim 6, wherein the distance (δ) between the downstream end of each of said lpivres in said exhaust gas flow and said side wall portion is not less than 0.5 times as large as the maximum height (h) of said louvre but not more than the maximum height (h) of said louvre.

8. A heat exchanger according to claim 1, wherein a plurality of said louvres are arranged in staggered fashion at angle to said exhaust gas flow along said exhaust gas flow.

9. A heat exchanger according to claim 8, wherein the distance (δ2) between the rear end portion of said louvre and said side wall portion adjacently arranged at an angle to said flat plate portion having said louvre is larger than the distance (δ1) between the forward end portion of said louvre and said side wall portion adjacently arranged at an angle to said flat plate portion having said louvre.

10. A heat exchanger according to claim 8, wherein, of a plurality of said louvres, the upstream louvre located upstream in said exhaust gas flow and the downstream louvre located downstream in said exhaust gas flow adjacently to said upstream louvre are arranged in such a manner that the forward end portion of said downstream louvre in said exhaust gas flow is located downstream of the rear end portion of said upstream louvre in said exhaust gas flow.

11. A heat exchanger according to claim 10,
wherein said upstream louvre and said downstream louvre are arranged in superposed relation with each other as viewed from the direction of said exhaust gas flow.

12. A heat exchanger according to claim 10,
wherein said upstream louvre and said downstream louvre are arranged in such a manner that the forward end portion of said upstream louvre and the rear end portion of said downstream louvre are displaced from each other as viewed from the direction of said exhaust gas flow.

13. A heat exchanger according to claim 10,
wherein said upstream louvre and said downstream louvre are arranged in such a manner that the rear end portion of said upstream louvre and the forward end portion of said downstream louvre are displaced from each other as viewed from the direction of said exhaust gas flow.

14. A heat exchanger according to claim 10,
wherein said upstream louvre and said downstream louvre are arranged in such a manner that the forward end portion of said upstream louvre and the rear end portion of said downstream louvre are substantially in superposed relation with each other as viewed from the direction of said exhaust gas flow.

15. A heat exchanger according to claim 10,
wherein said upstream louvre and said downstream louvre are arranged in such a manner that the rear end portion of said upstream louvre and the forward end portion of said downstream louvre are substantially in a superposed relation with each other as viewed from the direction of said exhaust gas flow.

16. A heat exchanger according to claim 8,
wherein the angle of the corner of the apex portion at the rear end portion of the louvre for which the distance from said flat plate portion is

longest is not less than about 90°.

17. A heat exchanger according to claim 8,

wherein the contour of the apex portion at the rear end portion of the louvre for which the distance from said flat plate portion is longest is a smooth curve.

18. A heat exchanger according to claim 8,

wherein said louvres are formed substantially in a trapezoid in such a manner as to have a surface of which the distance from the flat plate portion increases progressively downstream in the exhaust gas flow.

19. A heat exchanger according to claim 8,

wherein the distance (δ2) between the rear end portion of said louvre and said side wall portion is not less than 0.15 times as large as the maximum height (h) of said louvre but not more than twice as large as the maximum height (h) of said louvre.

20. A heat exchanger according to claim 19,

wherein the distance (δ2) between the rear end of each of said louvres in said exhaust gas passages and said side wall portion is not less than 0.15 times as large as the maximum height (h) of said louvre but not more than the maximum height (h) of said louvre.

21. A heat exchanger according to claim 10,

wherein the distance (δ1) between the forward end portion of said louvre and said side wall portion is not less than 0.15 times as large as the maximum height (h) of said louvre but not more than twice as large as the maximum height (h) of said louvre.

22. A heat exchanger according to claim 21,

wherein the distance (δ1) between the forward end portion of each of said louvres in said exhaust gas passages and said side wall portion is not less than 0.15 times as large as the maximum height (h) of said louvre but not more than the maximum height (h)

of said louvre.

23. A heat exchanger according to claim 10, wherein the tilt angle (θ) of said louvre to said exhaust gas flow is not less than 15° but not more than 45°.

24. A heat exchanger according to claim 1, wherein each of those parts of the inner wall of said exhaust gas passage (tube) which corresponds to said flat plate portion of said corrugated fin is formed with a second protrusion projected inward of said exhaust gas passage.

25. A heat exchanger according to claim 24, wherein said second protrusions are each formed at a part facing the inside of said flat plate portion.

26. A heat exchanger according to claim 24, wherein said exhaust gas passage (tube) has a flat section, and a plurality of said second protrusions are arranged in staggered fashion along the short diameter of said tube.

27. A heat exchanger according to claim 24, wherein said second protrusions are formed on the longitudinal end portion of said tube.

28. A heat exchanger according to claim 24, wherein a plurality of said tubes are arranged in parallel to each other, and a header tank communicating with a plurality of said tubes is coupled by being fitted in a fitting portion at each of the longitudinal end portions of each of a plurality of said tubes, and

wherein the shape of said fitting portion at one longitudinal end portion of said tube and the shape of said fitting portion at the other longitudinal end portion of said tube are different from each other.

29. A heat exchanger according to claim 24, wherein a plurality of third protrusions projected inward of said tube for setting said fins in

position with respect to said tube are formed on said tube.

30. A heat exchanger according to claim 1,

wherein said exhaust gas passage includes a plurality of tubes arranged parallel to each other, and a header tank communicating with a plurality of said tubes is coupled by being fitted in a fitting portion at each of the longitudinal end portions of each of a plurality of said tubes, and

wherein the shape of said fitting portion at one longitudinal end portion of said tube and the shape of said fitting portion at the other longitudinal end portion of each of said tubes are different from each other.

31. A heat exchanger according to claim 1,

wherein the upstream end portion of said louvres in said exhaust gas flow is formed continuously from the bottom surface of said corrugated fin.

32. A heat exchanger according to claim 1,

wherein the upstream end portion of said louvres in said exhaust gas flow has such a height (H) that the air flow riding over said louvre reaches the root of said louvre.

33. A heat exchanger for exchanging heat between the exhaust gas emitted from the internal combustion engine and a cooling fluid, comprising:

a flat exhaust gas passage through which said exhaust gas flows therein; and

a plurality of corrugated fins each arranged in said exhaust gas passage; and

a plurality of louvres which are formed on the inner wall of said exhaust gas passage, inclined at a predetermined angle to said exhaust gas flow direction, and

wherein said louvres include a first part having a such a height as to form a swirl reaching the bottom surface of said fin, and a second part which is

higher than said first part and located downstream of said first part in said exhaust gas flow.